1,091,118

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,091,118

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Int. Cl.:—F 16 l 9/00

COMPLETE SPECIFICATION

Method and apparatus for improving the Integrity of Concrete Ducts

I, RENÉ ROGIVUE, a Swiss Citizen, of Chemin du Renard 64, Aire-Vernier, Near Geneva, Switzerland, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of improving the integrity of concrete ducts, and to apparatus for carrying out the method.

It sometimes happens that buried concrete ducts, or joints of such ducts, deteriorate for various reasons. At present the usual means for improving the integrity of such ducts, e.g. restoring their fluid-tightness, involves excavation to expose the duct for repair, which involves expense comparable to the cost of laying the duct.

It has been proposed to intruduce into the duct two relatively movable pistons which substantially fit the interior of the duct, introduce a paste-like lining material between the pistons, and then draw the pistons along the duct by means of a cable which acts on the rear piston, such movement of the pistons squeezing the lining material between them and spreading it over the interior wall surface of the duct. It has also been proposed to provide a single piston of relatively complicated construction, having a centering device at one end which contacts the interior wall of the duct to centre the piston. For the purpose of introducing the lining material it has been proposed to provide a special opening in the wall of the duct which must be closed by a plug when the lining material has been introduced; it has also been proposed to provide a special filling funnel at one end of the duct.

It is an object of the present invention to provide an improved method which obviates the need for such special devices and the excavation their use entails.

A further object is to provide apparatus for carrying out the method, which embodies an improved form of single piston.

The method according to the invention comprises introducing into the duct through a permanent inspection hole or chamber thereof (of which there are usually several at intervals along the duct), a single piston surrounded by at least one resilient ring which substantially fits the interior of the duct, being of greater radial extent than any other part of the piston, also introducing into the duct on one side of the piston through the same or a different permanent inspection hole or chamber, a paste-like concrete-bonding material, and drawing the piston along the duct by traction means such as a cable which passes out of the duct through an inspection hole or chamber (usually a different one from that through which the piston was introduced), such movement of the piston forcing the bonding material into faults in the wall or joints of the duct.

According to another aspect of the invention, apparatus for carrying out the method comprises, in combination, a single piston having a rigid central portion encircled by at least one expansible ring which substantially fits the interior of the duct and is of greater radial extent than any other part of the piston, the piston also being provided on at least one side with means for attaching traction means such as a cable thereto, traction means such as a cable, and means, such as a winch, for applying traction to such traction means.

The invention may be performed in various ways and some specific embodiments may now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is an axial section of a portion of a duct containing a piston embodying one form of the invention;

Figure 2 is a longitudinal section of a duct, for example a sewer;

Figure 3 shows another form of the apparatus; and,

Figure 4 is a cross-section of a variant of the apparatus illustrated in Figure 3.

In the first embodiment as shown in Figure

1, there is illustrated an end portion 1 of a concrete pipe and the adjacent end portion 2 of the next concrete pipe, these being united by a joint 3. Into the duct thus formed, a hollow piston has been introduced, this piston comprising a central cylindrical portion 4 and two frusto-conical end portions 5 and 6.

Encircling the cylindrical body portion 4 are two resilient expansible rings 7 and 8, made for instance of rubber, which are a sliding fit in the bore of the duct.

The body of the piston may be made of metal or even of wood, for instance. On each of its ends are rings 9 and 10 to which can be attached traction means 11 and 12, for example cables.

Figure 2 shows, in longitudinal section, how a duct 13 such as a sewer is arranged. The duct is buried in the ground 14, and access can be had to it at intervals through permanent inspection holes or chambers 15. The duct 13 is made up of a number of lengths of concrete pipe secured end to end by joints.

The cables 11 and 12 are passed out of the duct through two inspection holes or chambers 15, being guided around pulleys secured temporarily at the bottoms of these holes or chambers. The cables are attached to winches (not shown) whereby a strong pull can be applied to the piston 4 in either direction.

An intermediate inspection hole or chamber is utilised for the introduction of a paste-like concrete-bonding material into the duct in front of the piston 4. This material may be introduced by means of a feeding device, for example a mixer, which discharges through a pipe into the intermediate inspection hole or chamber.

The concrete-bonding material will usually be made principally of cement or even of chalk, but it may be any material capable of remaining for some time in a paste-like state and then setting to form a bond with the concrete of the duct.

By drawing the piston 4 against the bonding material, the bonding material will be squeezed against the walls of the duct and forced outwardly into faulty joints and other faults in the wall of the duct. It may be advantageous to repeat the operation by moving the piston back and forth.

Thereafter, repair to a further length of the duct can be effected by moving the pulleys and generally also the means for supplying the bonding material. However, it is not always necessary to add additional bonding material for a further length of the duct, as a single charge of the bonding material is often sufficient to serve several successive lengths.

When the operation is finished the interior of the duct generally presents a clean and smooth surface. Should this not be the case, it is usually sufficient to pass through the duct a smoothing device such as a cylindrical metal brush which is pulled along the duct, like the piston, by a winch.

Some of the bonding material may pass right through the joint, forming outside a wad of bonding material which exerts pressure against the soil; this will further improve the integrity of the duct.

It has been found that it is possible to dispense with a second piston, the resistance of the paste-like bonding material itself being sufficient to provide the pressure needed to force the bonding material into the joints or faults in the duct wall.

In Figure 3 there is shown a joint 35 between two adjoining concrete pipes of the duct 34.

Inside the duct is a piston consisting of a rubber disc 36 squeezed between two flanges 37 and 38 provided with eyelets to which cables 39 can be attached. At one side of the piston 36 is the paste-like bonding material 40. In this embodiment the piston 36 has a diameter which is slightly less than the internal diameter of the duct 34 so that the piston is surrounded by an annular clearance 41. The radial width of this clearance may be, for example, about 1 cm.

When the piston 36 is forced against the bonding material 40 it not only presses the material into the joints and the faults but also forms the material into a lining 41 on the interior wall of the duct.

Figure 4 shows a variant. In Figure 4 the duct is shown in cross section at 42.

It often happens, in consequence of the flow of fluid through the duct, especially when the fluid contains sand or other abrasive particles and the duct is inclined, that the bottom portion of the duct wears thin.

By providing the disc-like piston 44 with a flattened portion 45 adjacent to the bottom of the duct the width of the clearance is increased in this region so that here the lining is thickest, thereby compensating for the wear and strengthening the duct in this region.

With the second embodiment and its variant, shown in Figures 3 and 4 respectively, repairing a duct will generally involve first passing a brush through by the joint-filling and lining operation described, and possibly by a second pass of the piston through the duct with a view to smoothing the lining.

The method and apparatus of the invention are applicable not only to circular ducts but also to ducts of other cross-sectional shapes. If the cross-section of the duct changes, all the elements of the apparatus can still be used except for the piston, which is replaced by another piston having dimensions suited to the changed cross-section.

When a secondary duct, generally of smaller cross-section, opens into the main duct, it is necessary to prevent the bonding material from being pushed into the secondary duct and blocking it. For this purpose there can be

added to the apparatus described an obturating device comprising a flexible rod (which may be made in two or more lengths which can be assembled together) having at its end an inflatable obturating member connected to a tube through which it can be inflated. For example, the flexible rod may consist of bamboo canes or plastic rods, one of which carries on its end a bladder-like member made, for instance, of rubber and connected to a pump by means of a flexible tube. By this means it is possible to move the device into the mouth of the secondary duct and there inflate it to obturate the secondary duct.

WHAT I CLAIM IS:—

1. A method of improving the integrity of a concrete duct which comprises introducing into the duct through a permanent inspection hole or chamber thereof a single piston surrounded by at least one resilient ring which substantially fits the interior of the duct, being of greater radial extent than any other part of the piston, also introducing into the duct on one side of the piston, through the same or a different permanent inspection hole or chamber, a paste-like concrete bonding material, and drawings the piston along the duct by traction means which passes out of the duct through an inspection hole or chamber, such movement of the piston forcing the bonding material into faults in the wall or joints of the duct.

2. A method as claimed in Claim 1 in which the (or each) resilient ring is a clearance fit in the duct whereby the movement of the piston produces a lining of the bonding material on the wall of the duct.

3. A method as claimed in Claim 2 in which the clearance is greater in a segment of the (or each) ring so that a lining of greater thickness is applied in the region of the duct transversed by this segment.

4. Apparatus for carrying out a method as claimed in Claim 1 comprising, in combination, a single piston having a rigid central portion encircled by at least one resilient ring which substantially fits the interior of the duct and is of greater radial extent than any other part of the piston, the piston also being provided on at least one side with means for attaching traction means thereto, traction means, and means for applying traction to such traction means.

5. Apparatus as claimed in Claim 4 in which the (or each) resilient ring is a clearance fit in the duct.

6. Apparatus as claimed in Claim 4 to Claim 5 in which a segment of the periphery of the (or each) ring is flattened.

7. Apparatus as claimed in any of Claims 4 to 6 which also includes a flexible rod ending at an expansible obturating element.

8. A method of improving the integrity of a concrete duct substantially as described with reference to Figures 1 and 2 or Figures 3 and 4 of the accompanying drawings.

9. Apparatus substantially as described with reference to Figures 1 and 2 or Figures 3 and 4 of the accompanying drawings.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicant.

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Fig.1.

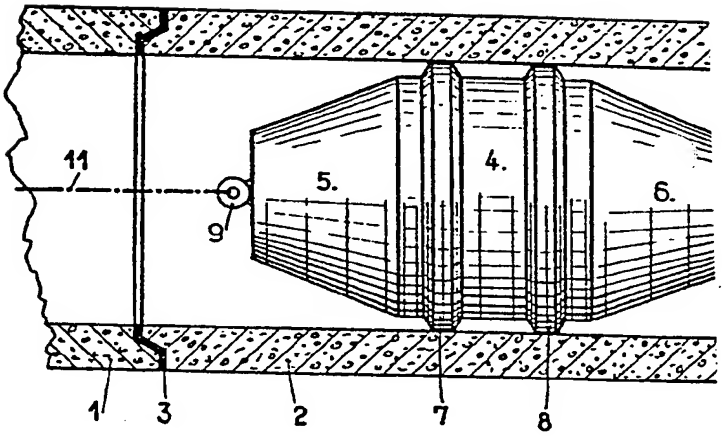
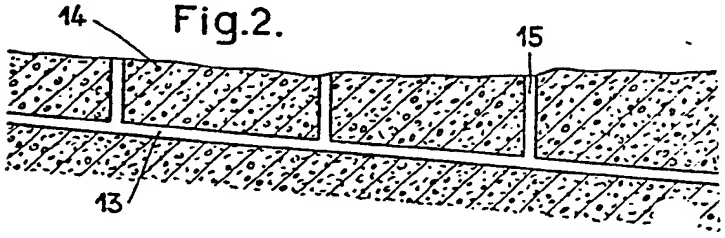


Fig.2.



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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

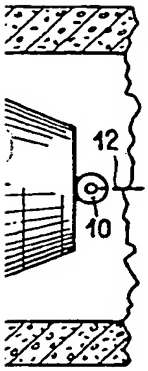
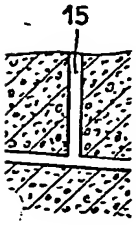


Fig. 3.



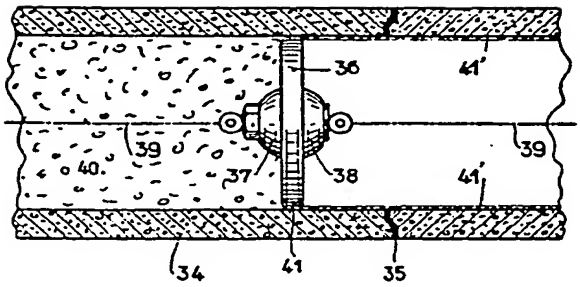
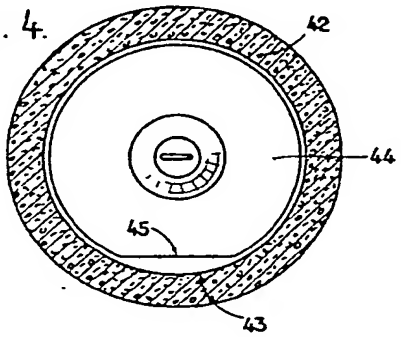


Fig. 4.



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Sheets 1 & 2

Fig.1.

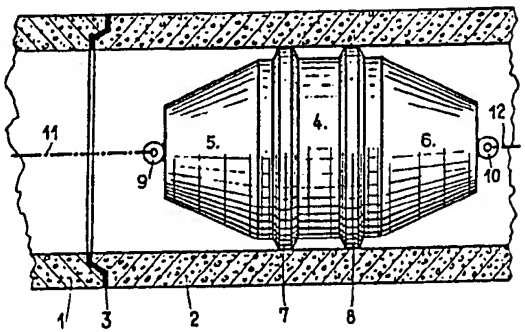

Fig.2.

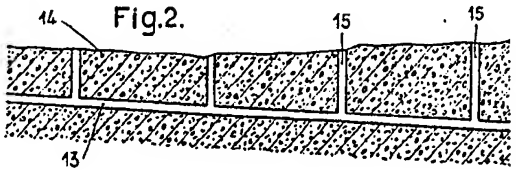

Fig. 3.

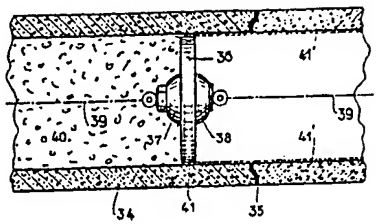

Fig. 4.